



## Materials Engineering Branch

### TIP\*



No. 138      Electro-Slag Re-melted Steel Bearings

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A request was made for approval to use electro-slag re-melted (ESR) 440C steel bearings instead of vacuum melted (VAR) 440C steel. Since Miniature Precision Bearing (MPB) Corporation stocks ESR steel, the use of ESR steel would reduce the bearing delivery time by about four months. A copy of an MPB study of inclusion content in air melted, VAR and ESR 440C steel was included with the request.

The inclusion study concluded that only 13% of air melted steel was acceptable for bearings whereas 89% of ESR and 97% of VAR steel was acceptable for bearing fabrication. Thus, MPB concluded that ESR steel was almost as free of inclusions as VAR steel. As a result MPB began using ESR steel for many bearing types to avoid rejected bearings due to pitted surfaces. Experience with space flight bearings has shown that bearing failures do not result from fatigue cracks that originate at inclusions. Therefore the small increase in inclusion content in ESR steel, relative to VAR steel, is not expected to increase the bearing failure rate.

Although VAR 440C steel is preferred for space flight bearings, ESR 440C steel bearings are acceptable if the surface roughness is not increased.